African-European Early-Career Network for Mathematical Analysis and Related Fields

Meeting 09.01.26 17:00-19:00 CET

Program

Math Talk | 45 *min*

Robust log-convex interpolation inequalities via Chebyshev-type inequalities.

By Guy Foghem, B-TU Cottbus

Abstract: We investigate several Chebyshev-type inequalities for general non-monotone functions. These inequalities play a central role in deriving robust log-convex interpolation inequalities within the scale of (fractional) Sobolev seminorms. As applications of these results, we explore topics such as asymptotic compactness, convergence of Sobolev traces, and the convergence from nonlocal to local behavior for weak solutions of the boundary Dirichlet problem associated with the regional fractional p-Laplacian $(-\Delta)_{p, \Omega}^s$, with $s \in (0,1]$ and $p \in (1,\infty)$, on smooth a domain $\Omega\subset \mathbb{R}^d$.

Math Talk | 30 *min*

Thermal and sensitivity analysis on regularized curved solar panels using non-Newtonian quaternary hybrid nanofluids: Applications of NS-equations

By Yusuf Abdulhakeem, Federal University of Technology Minna, Nigeria

Abstract: Regions like West Africa experience high solar irradiance; however, the utilization of solar thermal energy remains limited due to system inefficiencies and the risk of overheating. The ongoing investigation focuses on enhancing thermal performance by optimizing a geometrically curved solar panel system and assessing heat absorption mechanisms to mitigate overheating. To enhance this performance, a quaternary hybrid nanofluid consisting of a non-Newtonian fluid (sodium alginate) and four nanoparticles is utilized within the curved solar panel system. Variable heat absorption mechanisms are integrated to mitigate fluid overheating. The representation of this system was initially expressed in partial differential equations and subsequently converted into ordinary differential equations (ODEs) to facilitate analysis. To address complex singularities arising from the non-Newtonian terms, a regularizer is introduced. The solutions to the ordinary differential equations are derived using the Galerkin weighted residual method (GWRM). A sensitivity analysis was conducted using Simpson's rule, and the regularizer demonstrated insensitivity to the solution. Consequently, the results agree with literature-reported values of skin friction coefficient. The sodium alginate quaternary hybrid nanofluid demonstrates a thermal efficiency increase of approximately 37% compared to the water-based quaternary hybrid fluid. The study indicates that as the curvature parameter increases (the curved solar panel flattens), the thermal efficiency of the fluid decreases. At elevated temperatures, possibly because of nonlinear radiation, the spatial and temperature-dependent absorption reduces fluid

temperature and enhances thermal efficiency. This reveals that the system offers energy solutions tailored to the specific needs of the region.